METHOD FOR DISPENSING ADHESIVE ON A CIRCUIT-BOARD CARRIER MEMBER AND CIRCUIT-BOARD PROVIDED THEREBY

Background of the Invention

The invention relates to a method for dispensing adhesive on a circuit-board carrier member and a circuit-board produced by such method.

Circuit-boards for high-frequency use are known which comprise a carrier or some sort of housing member and, mounted thereon, a number of separate components, in particular substrates and/or electronic (mainly active) components. In microwave applications such electronic components may include MMICs. These components are secured to the carrier/housing via an electrically conductive adhesive. The adhesive acts to create electrical continuity between a metallised ground area on the substrate and the grounded carrier. Such an arrangement is shown in Figure 1, in which two substrates 11, 12 are fixed by adhesive layers 13, 14 to a common carrier 15. Deposited on the two substrates are respective 50 Ω lines 16, 17 which terminate in respective multiple bond-pad sites 18, 19. Linking opposite pairs of sites are wire-bonds 20, which may have been mounted using the well-known ball-and-wedge or wedge-and-wedge bonding techniques.

The wire bonds possess an intrinsic inductance which, in conjunction with a parasitic capacitance associated with the pads 18, 19, gives rise to a low-pass filtering effect 22 on any signal carried by the lines. In order to ensure that the corner-frequency of such a filter is sufficiently and reproducably high relative to the highest frequency of interest in the line signals, the wire-bonds are normally all made of the same length throughout the circuit-board (constant-wire-length (CWL) technique) and the pads are dimensioned and spaced such as to give rise to a low stray capacitance.

In order to ensure that the stray capacitance between the bond-pads 18, 19 and the carrier 15 is sufficiently low, it is advisable to strive for a termination of the adhesive layer at the substrate edge 21 which is as abrupt as possible. Should the adhesive find its way into the gap between the substrates or, worse still, end up covering one or both of the end-faces 22 of the substrates and/or well up into the gap, then the parasitic capacitance increases and the corner-frequency of the low-pass filter decreases, with a consequent deleterious effect on performance. This effect is illustrated in Figure 2. Here the adhesive can be seen to have welled up into the gap 30, thereby creating new stray capacitance 31 between the bond-pads 18, 19 and the carrier 15.

The conventional way of applying adhesive to the carrier is to spread the adhesive in one of a number of patterns, namely stripes, spots, star-shapes, crosses, double-crosses, etc. One of the commonest patterns is the simple stripe, as shown in Figure 3. It will be noted that, where each line of adhesive is begun and ended, there is an accumulation of adhesive 35. Similarly, where the adhesive is applied in patterns other than a straight-line pattern, accumulations can also occur at other discontinuities, namely at those points at which the direction of travel of the adhesive is changed. An example of this is a 90° bend, in which accumulations occur at the ends of the angled line and also at the right-angle bend point.

Use of this technique in connection with two adjacent substrates linked by wire-bonds is illustrated in Figures 4a and 4b. Here the substrates (or MMICs, for example) are pressed onto the adhesive stripes, which spread slightly under the pressure, thereby partly filling in the inter-stripe gaps, and the adhesive is then allowed to set. Before this occurs, however, the build-ups 35 of adhesive at the end-discontinuities are subject to a squeezing

action outwards, as illustrated in Figure 4b, which then results in adhesive finding its way into the inter-substrate gap 30, as shown also in Figure 2. Thus, while this known technique satisfies one design requirement, namely that the conductive adhesive should reach as far up to the edge of the substrate as possible in order to provide the best possible grounding of the substrate, it does not satisfy the second requirement, which is that adhesive should not find its way into the intersubstrate gap, thereby increasing stray capacitance.

Summary of the Invention

In accordance with a first aspect of the invention there is provided a method for dispensing adhesive on a circuit-board carrier member as recited in Claim 1 and under a second aspect of the invention there is provided a circuit-board having two components secured to a carrier member by an adhesive as recited in Claim 8. Advantageous embodiments of the invention are contained in the sub-claims.

Brief Description of the Drawings

An embodiment of the invention will now be described, by way of example only, with reference to the drawings, of which:

Figure 1 is a sectional view and plan-view of a typical circuit-board arrangement involving two substrates and a carrier;

Figure 2 shows the effect of adhesive migration into a gap separating the two substrates of Figure 1;

Figure 3 is an example of an adhesive pattern as applied to the carrier;

Figures 4a and 4b illustrate, respectively, a conventional method of securing two neighbouring substrates by adhesive to a carrier, and the effect in such conventional method

of the adhesive accumulations at the edges of the substrates when the substrates are mounted;

Figure 5 depicts a method according to the present invention for securing two neighbouring and interconnected substrates by adhesive to a carrier, and

Figure 6 shows a way according to the present invention of adhesively fixing three neighbouring substrates to a carrier, these substrates involving two orthogonal wire-bond transitions.

Detailed Description of an Embodiment of the Invention

Referring now to Figure 5, which corresponds essentially to the arrangement shown in Figure 1, two substrates 11, 12 are bonded to a carrier (not shown) by an adhesive applied as stripes, but in this case the stripes are applied at 90° to the direction of the transition between the substrates, i.e. at 90° to the direction of the wire-bonds 20. Since now the accumulations of adhesive occurring at the start and end of each stripe are outside the footprint or area of the substrates, there is far less risk that any adhesive will find itself wandering into the gap 30 and so the stripes nearest the edges of the substrates can be allowed to lie quite close to those edges without fear of migrating into the gap 30. Furthermore, since the portion of each stripe lying underneath each substrate will be substantially uniform in diameter or thickness, when the substrates are pressed downwards onto the adhesive it is less likely that any undesirable gaps (hollow pockets) will arise between the substrates and the adhesive. The result is sound adhesion of the substrate face to the carrier and, at the same time, no build-up of adhesive in the inter-substrate gap to cause performance problems.

A situation in which three substrates are mounted adjacent to each other on a carrier is shown in Figure 6. In Figure 6 a line 40 on a first substrate is wire-bonded at one end to a line 42 on a second substrate 43 and at the other end to a line 44 on a third substrate 45. In this case the stripes under the various substrates run as shown, with those 50, 51 either side of the first transition 46 running transverse to the direction of that transition, while those 52, 53 either side of the second transition 47 run transverse to the direction of that transition and also transverse to the direction of the stripes 50, 51.

Whereas in the Figure 5 scenario all the end-discontinuities of the adhesive stripes lay outside the footprint of the two substrates, so that it was assumed that the width and height above the carrier of the stripes within that footprint was more or less constant over that footprint, in the Figure 6 case the adhesive build-ups 54 at one end of the stripes 52 lie within the footprint of the substrate 41. This can have the less-than-ideal effect that some gaps may occur between that substrate and the various adhesive stripes following mounting of the substrate on the carrier. Notwithstanding this, however, the build-ups 54 are still outside the area of the transition 47 and therefore the stripes 55 at the facing edges of the substrates 41 and 45 can still lie quite close to those edges without risk of migration of adhesive into the gap between those substrates.

Although the various drawings show the adhesive as running at 90° to the direction of transition, it is not necessary that this be actly 90° in order to enjoy the benefits of the invention. However, it is best to have the adhesive running as parallel to a transition-edge of the substrate concerned as possible (see, for example, the transition-edge 60 in Figure 6), since then there will be optimal coverage of the adhesive up to all points along the substrate edge.

While in Figure 5, for example, all the adhesive stripes associated with the substrates 11, 12 are oriented in the same direction, in practice it is only necessary for those in the immediate vicinity of the transition between the two substrates to have the orientation shown; the others may have a different orientation (e.g. parallel to the direction of transition), if required. However, in that case – as already mentioned in connection with Figure 6 – there may be an increased risk of gaps occurring in places between the underside of the substrate and the adhesive due to the possible existence of adhesive accumulations within the footprint of the substrates in the non-transition regions.